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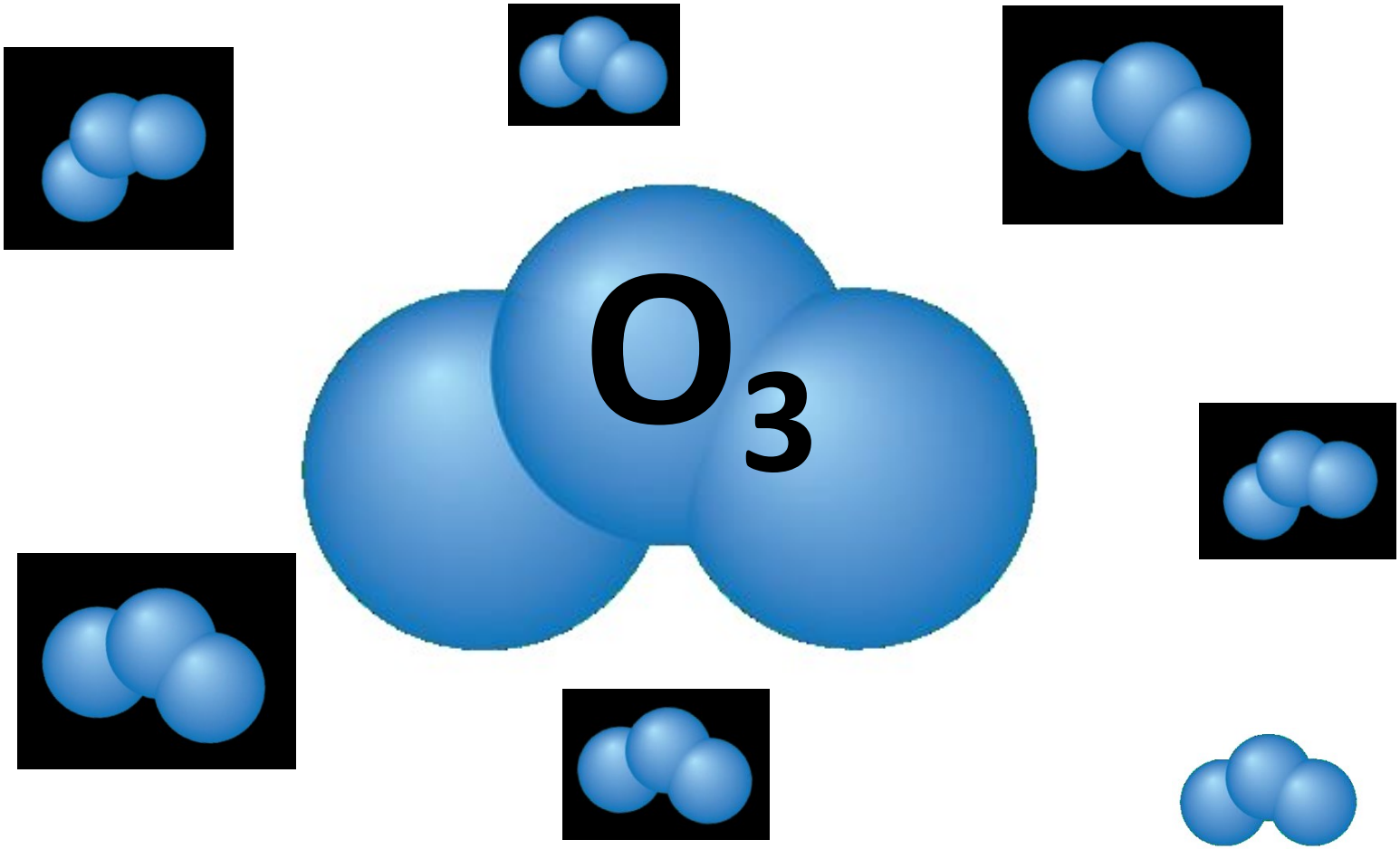
CAPTOR

TROPOSPHERIC OZONE POLLUTION: THE CAPTOR EXPERIENCE

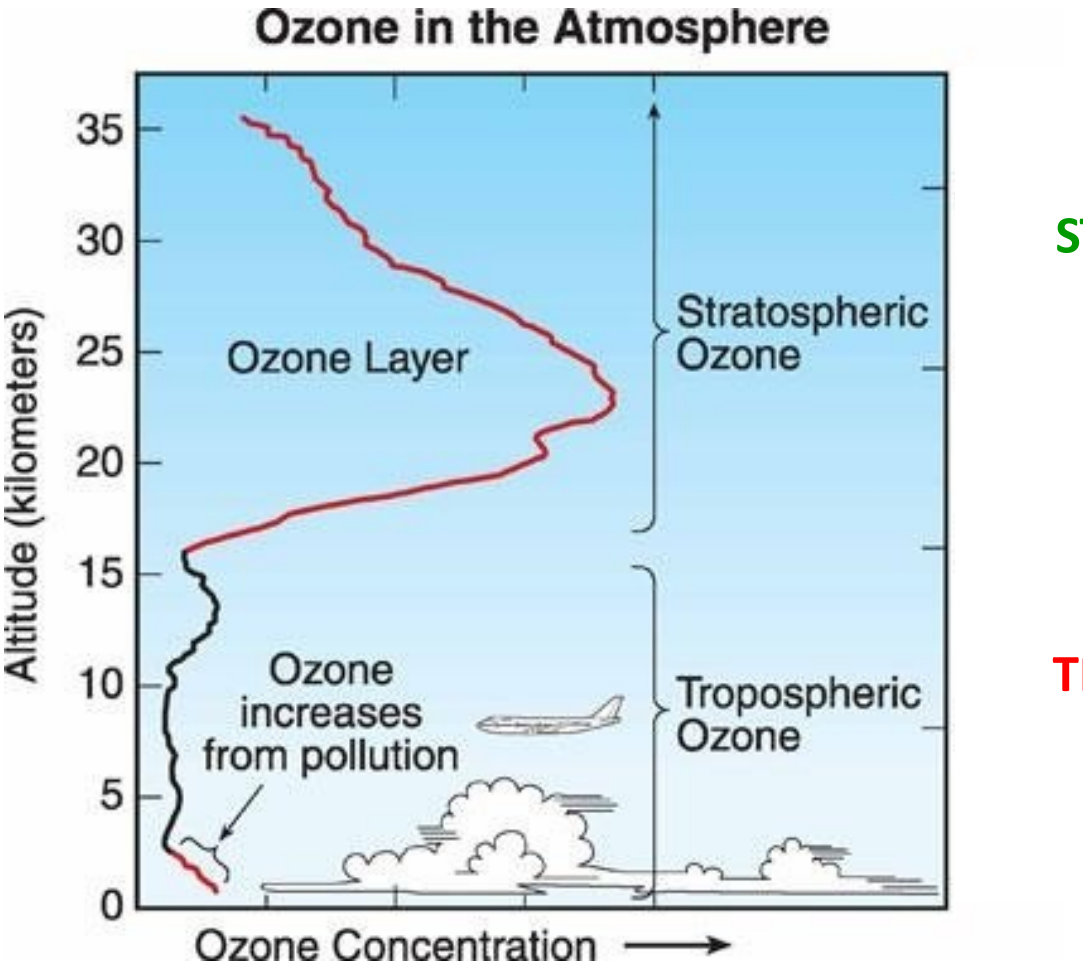
CSIC
Consell Superior d'Investigacions Científiques

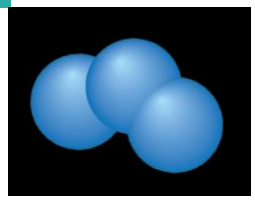
Alice De Marco
Torino, 7 maggio 2019

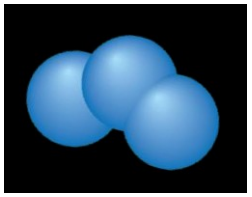
What is ozone?



What is tropospheric ozone?







STRATOSPHERIC OZONE

(forms the Earth's protective ozone layer)

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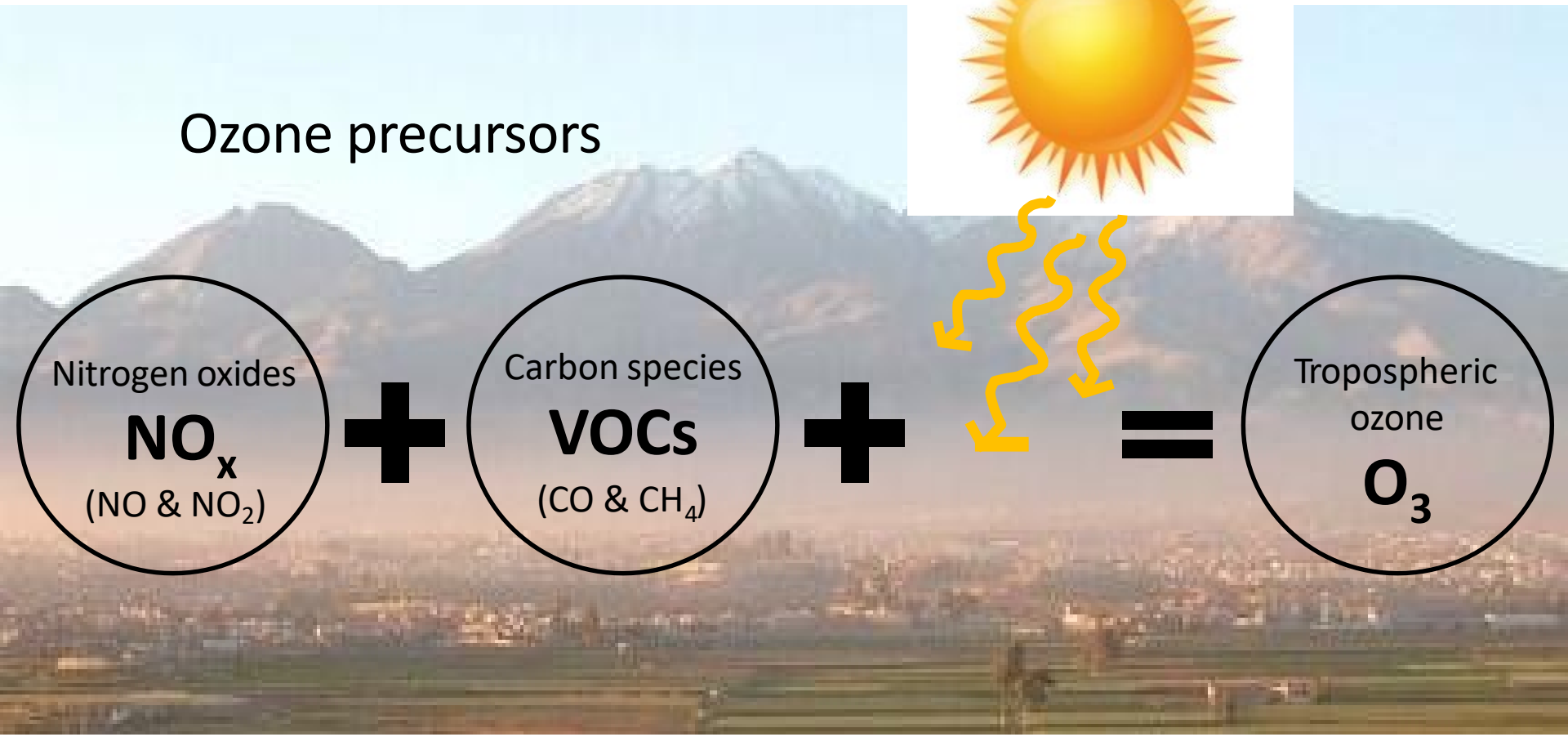
TROPOSPHERIC OZONE

(affects human health and vegetation)

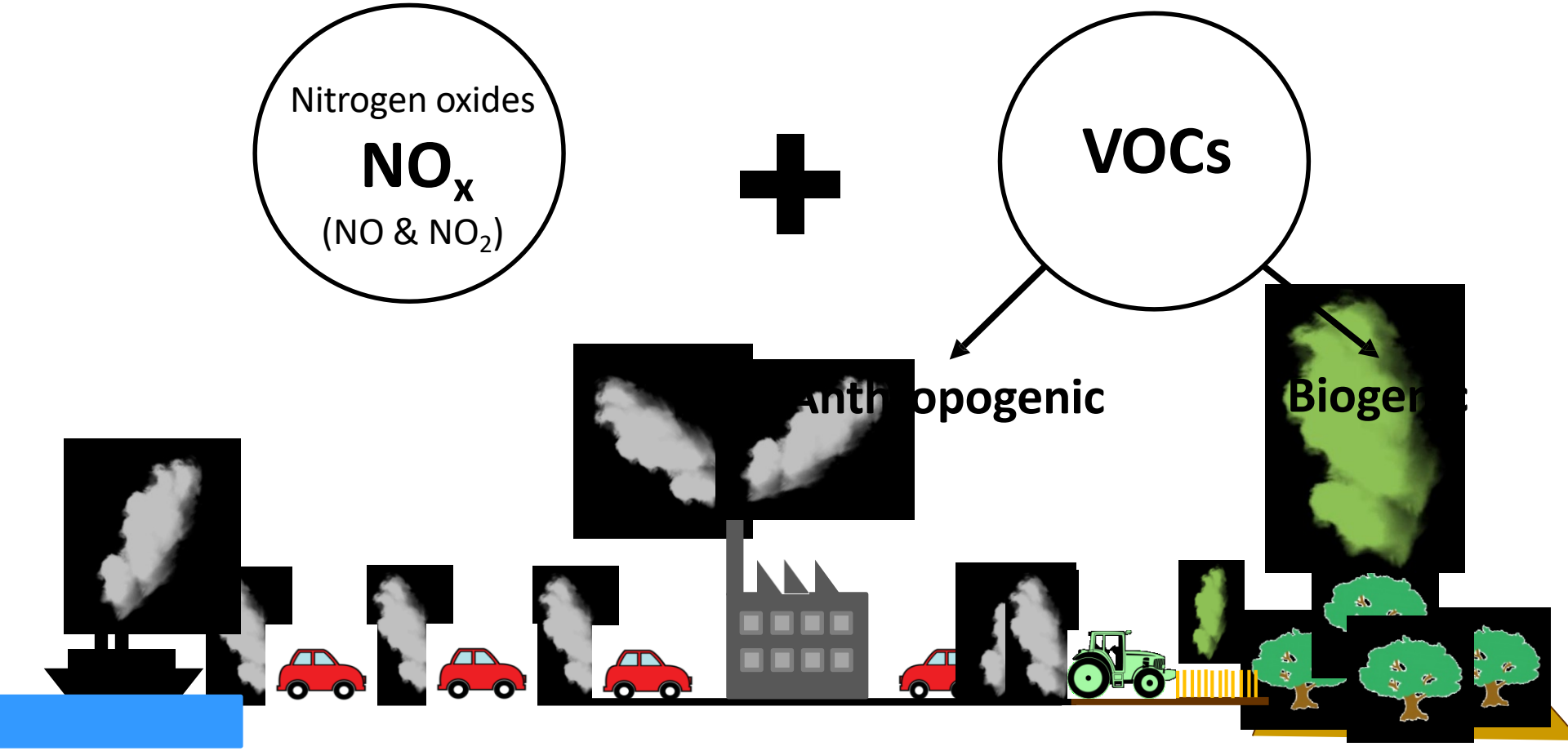
How is tropospheric ozone formed?

Ozone precursors



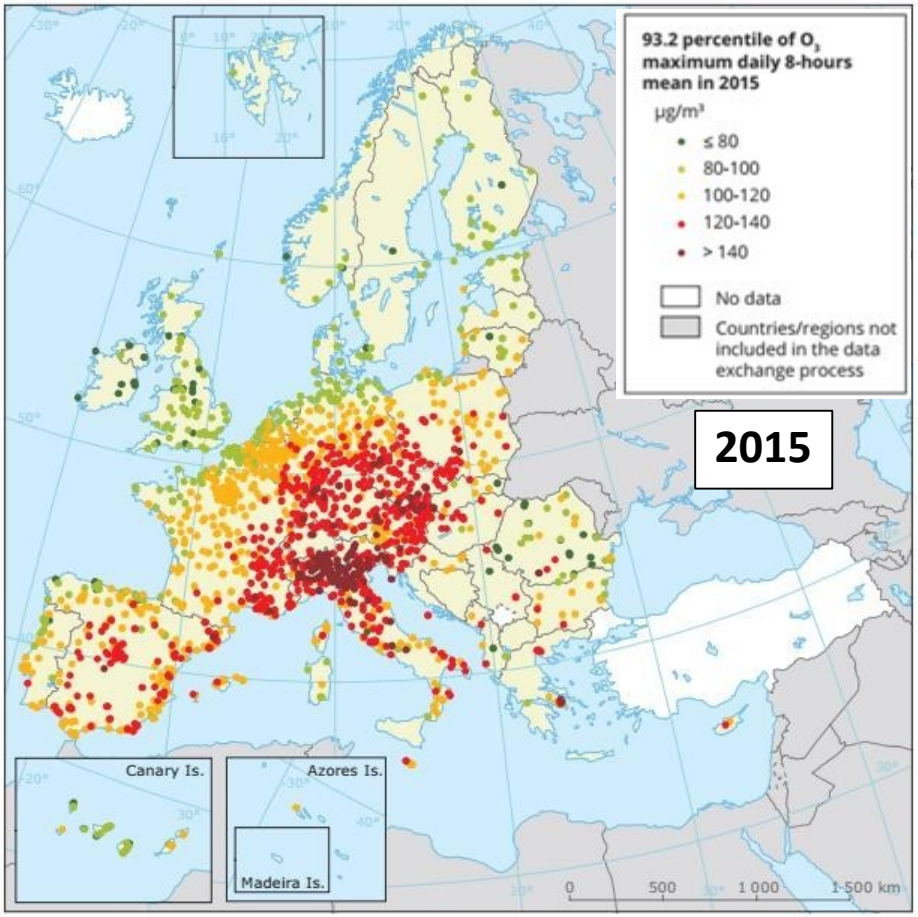
How is tropospheric ozone formed?

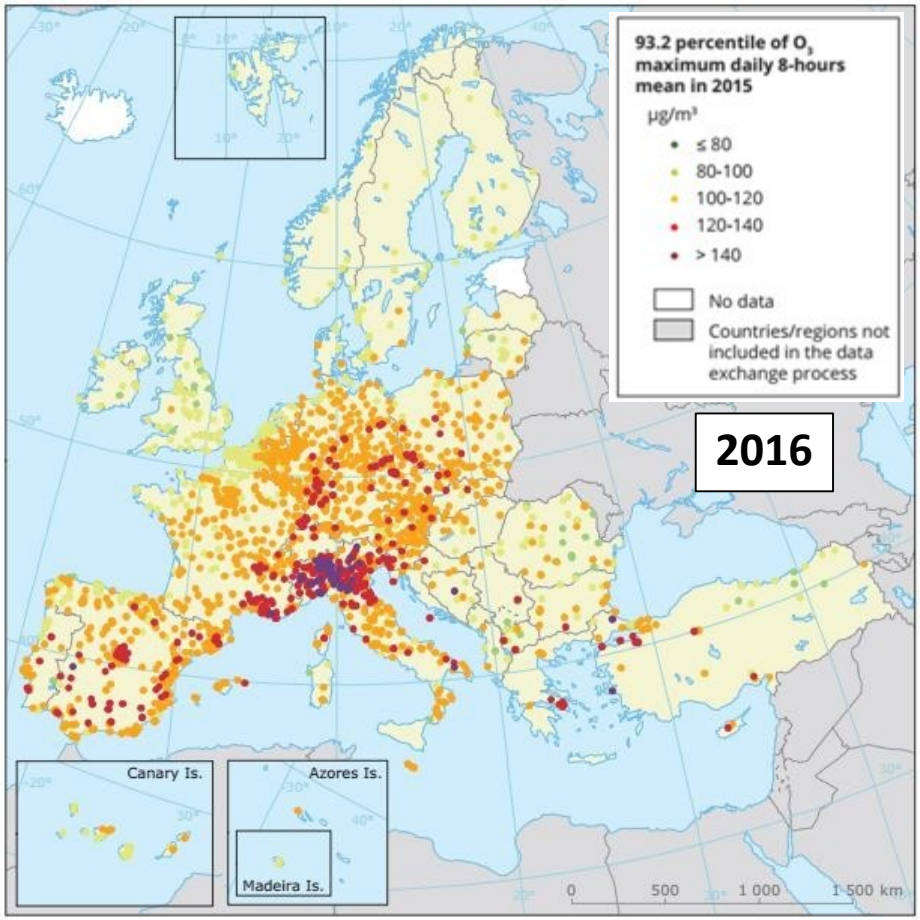
Ozone precursors



Ozone in Europe

EEA Air Quality in Europe





Large interannual variability dependent on meteorology

Ozone in Europe

EU target value for protection of human health (120 microg/m³)

- 17% of stations > O_3 target value for protection of human health.
- 17% (2016) << 41% (2015), but higher than in 2014 - interannual variability.

WHO AQ guideline (100 microg/m³)

- 96% of stations > WHO AQG value for O_3.

Table ES.1 **Percentage of the urban population in the EU-28 exposed to air pollutant concentrations above certain EU and WHO reference concentrations (minimum and maximum observed between 2014 and 2016)**

Pollutant	EU reference value (a)	Exposure estimate (%)	WHO AQG (a)	Exposure estimate (%)
$PM_{2.5}$	Year (25)	6-8	Year (10)	74-85
PM_{10}	Day (50)	13-19	Year (20)	42-52
O_3	8-hour (120)	7-30	8-hour (100)	95-98
NO_2	Year (40)	7-8	Year (40)	7-8
BaP	Year (1)	20-24	Year (0.12) RL	85-90
SO_2	Day (125)	< 1	Day (20)	21-38

EEA Air Quality in Europe, 2018

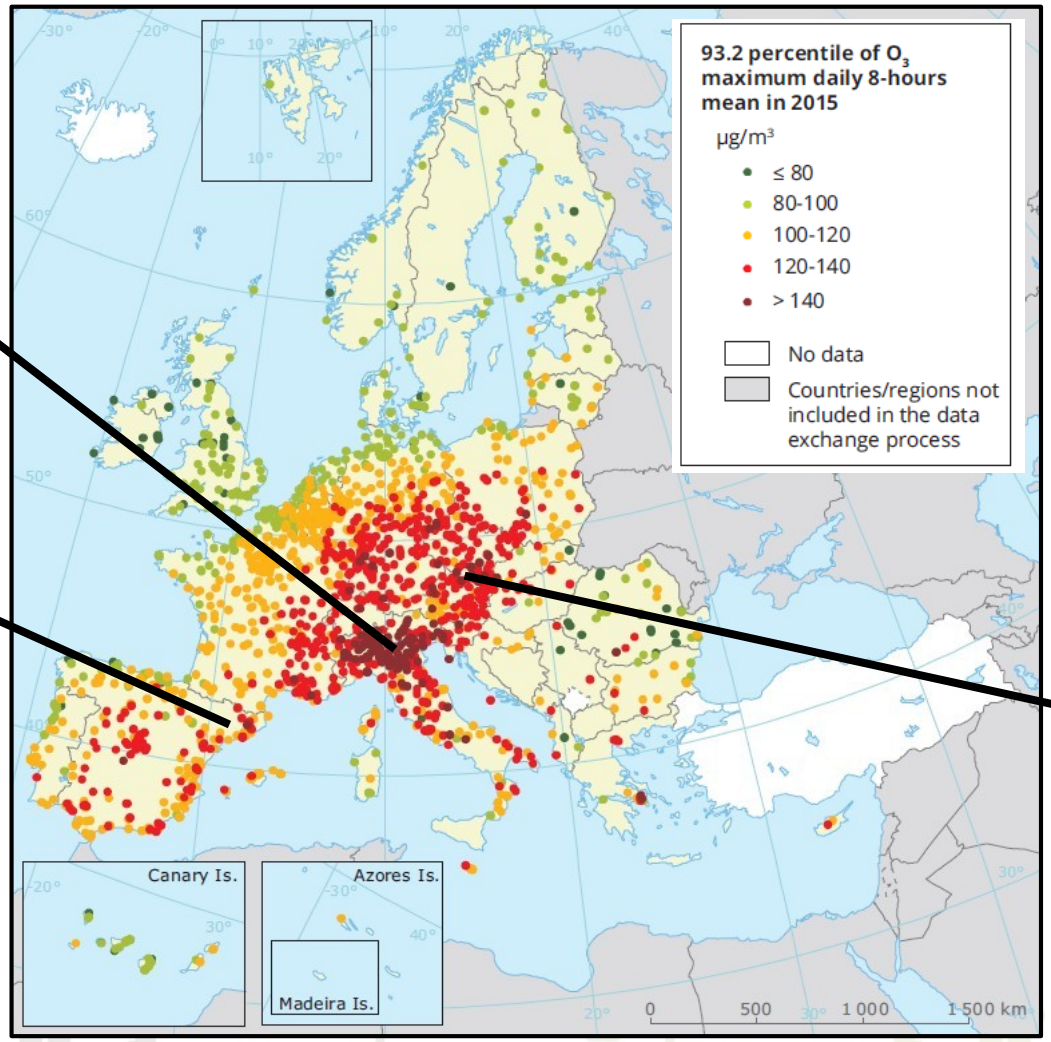
CAPTOR: Objectives

- To **foster bottom-up collaboration of local communities, citizens, NGOs, and scientists**, to raise awareness of air pollution problem, and especially of tropospheric ozone.
  - To engage a **network of local communities** in three European regions for **monitoring tropospheric ozone**.
  - To give technical support in developing **low-cost sensors** and data manager.
  - To empower citizens and engage them in promoting **active participation in decision making to drive solutions**.

Study areas

Italy:
Piedmont,
Lombardy,
Emilia
Romagna and
Veneto

Spain:
Barcelonès,
Vallesos,
Maresme
and Osona

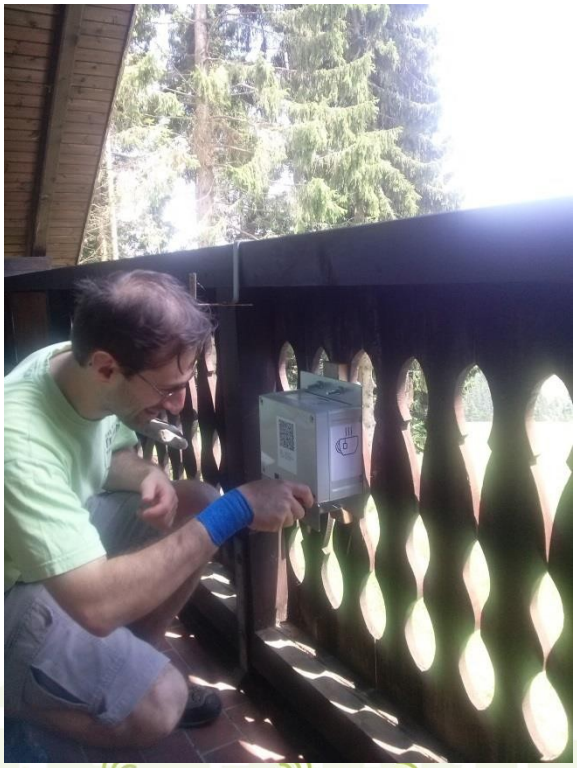


Austria:
Burgenland,
Steiermark and
Niederösterreich

Workplan

2016	2017	2018

Citizen measurement campaigns of tropospheric ozone



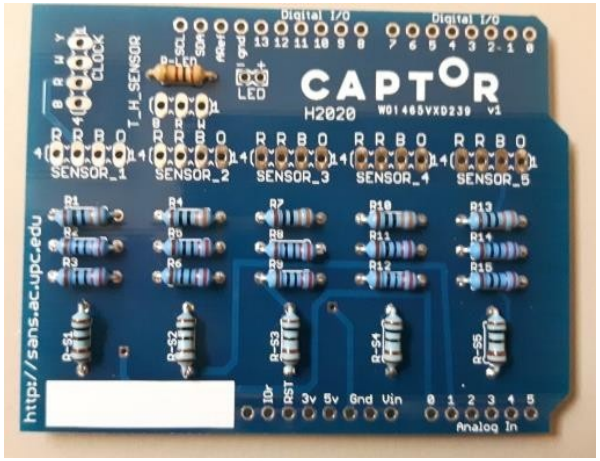
Low-cost sensors developed

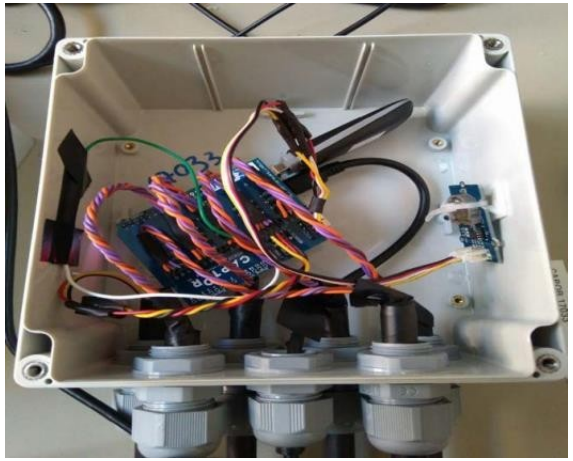
CAPTOR:
metal oxide
low-cost sensors (UPC)

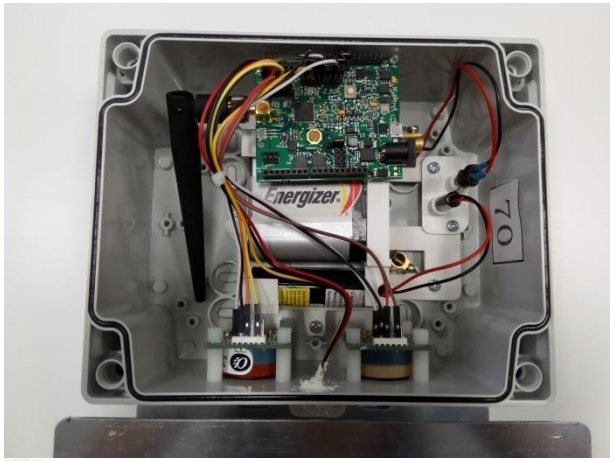
RAPTOR:
electrochemical
low-cost sensors (UCA)

	Captors	Raptors
Spain	25	1
Italy	10	10
Austria	0	15

Low-cost sensors developed



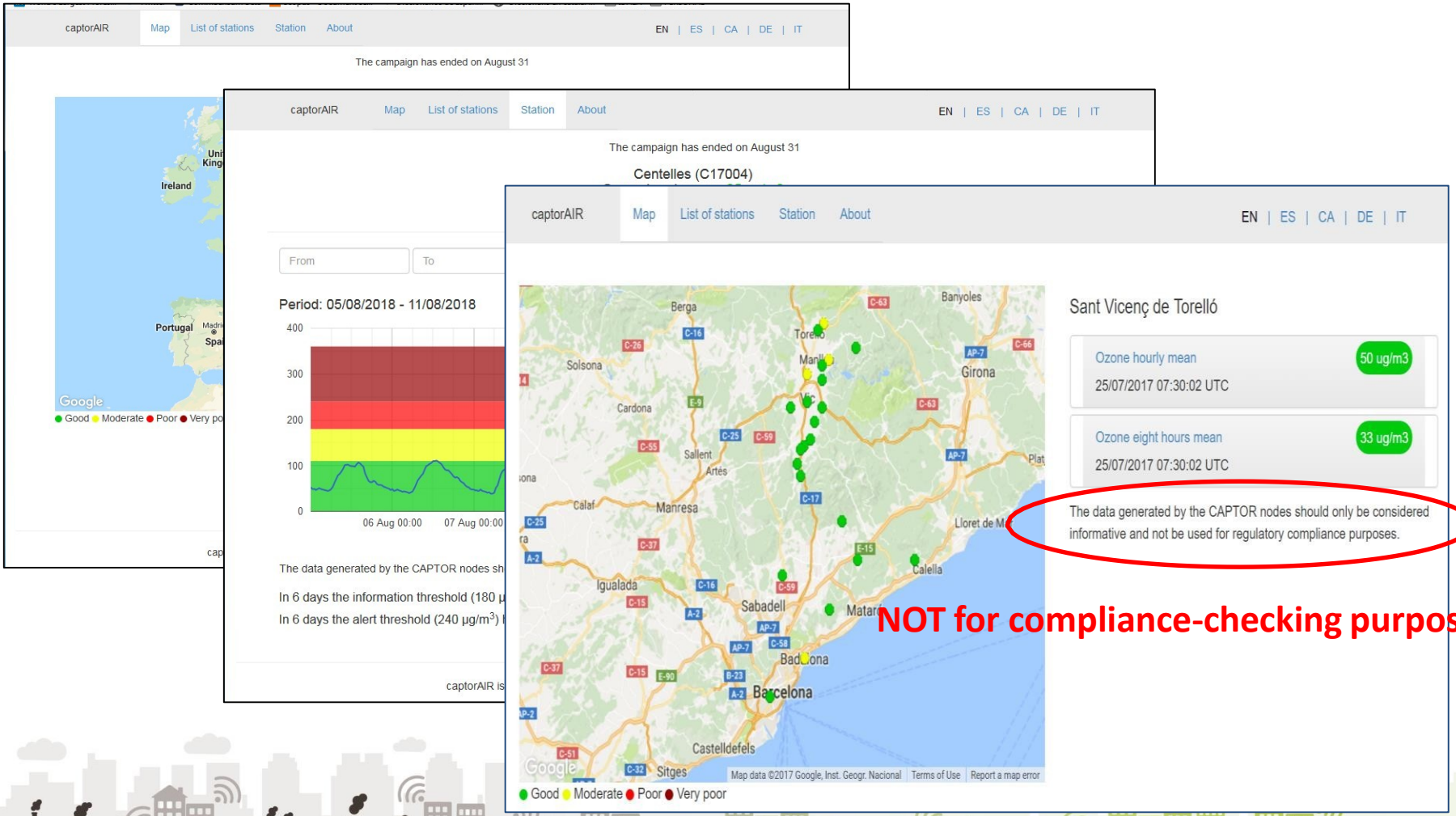




Low-cost sensors calibration

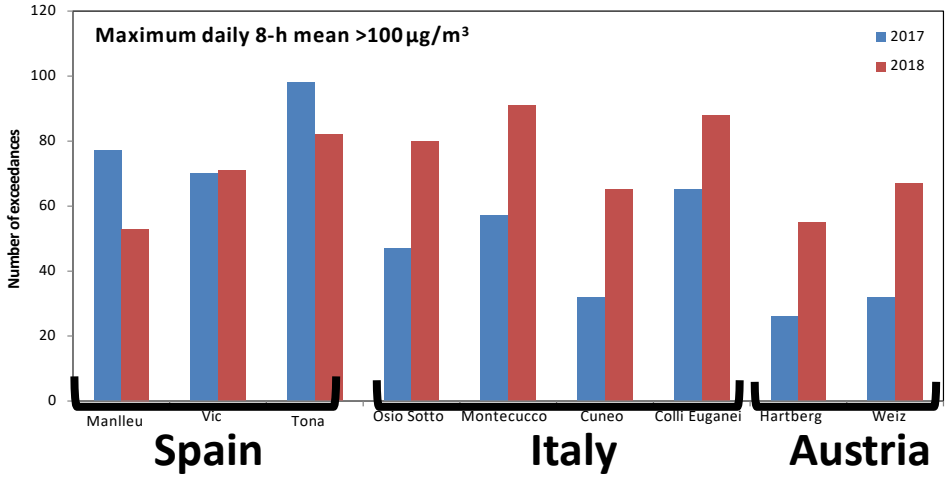
Where to check the data?

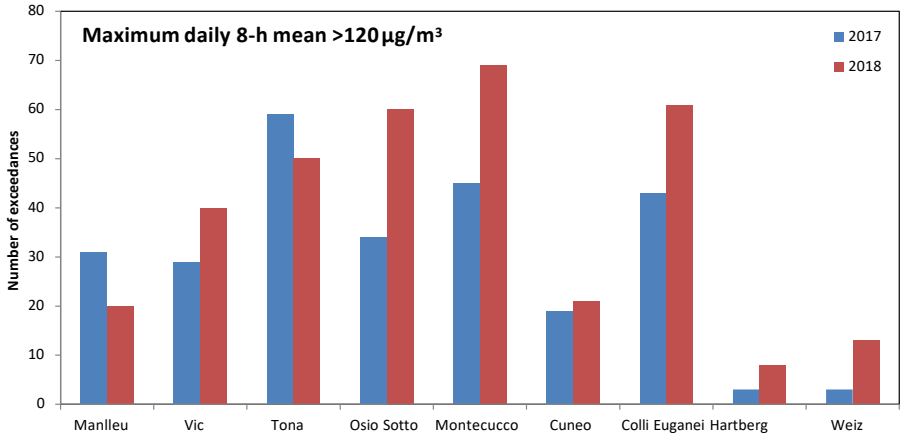
https://captorair.org/list/

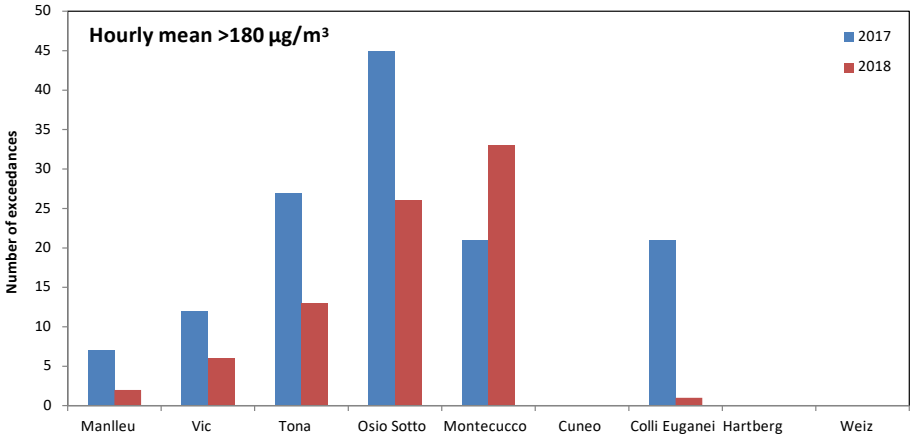


NOT for compliance-checking purposes!

Results



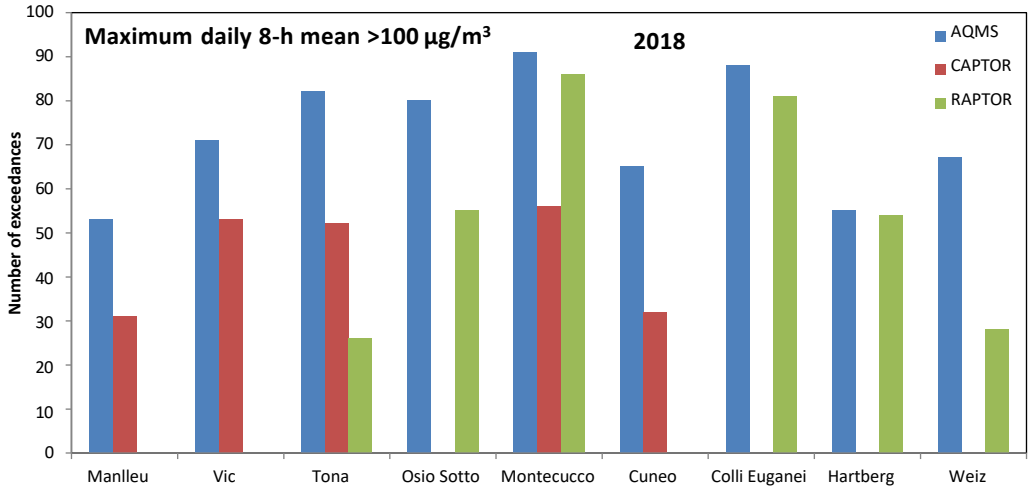




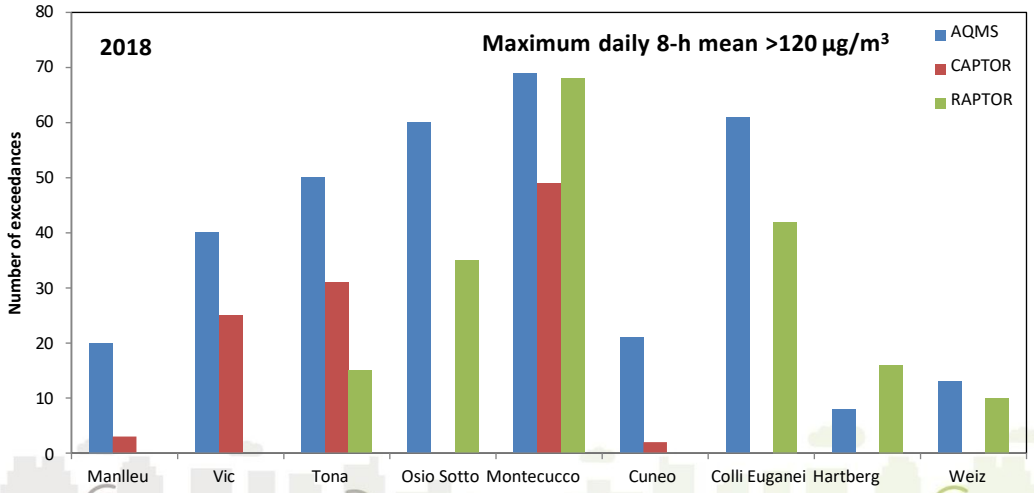
Sensor data useful to assess:

- Geographical variability: Italy/Spain/Austria
- Temporal variability: relative differences 2017 – 2018

Results



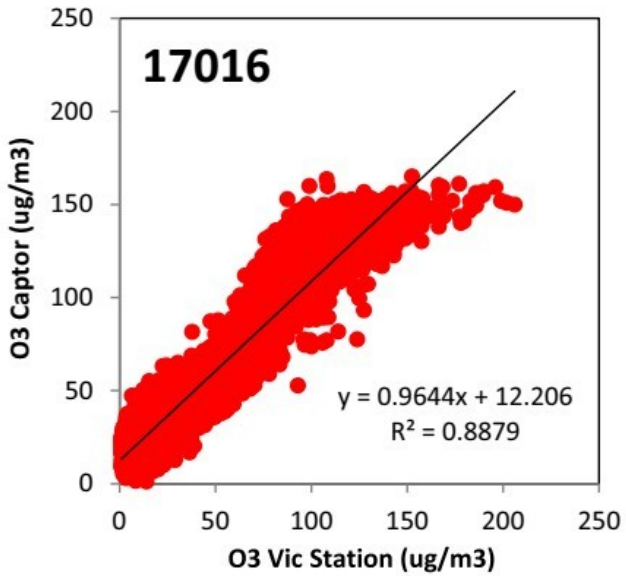
Sensor data are more conservative than reference stations – no social alarm created

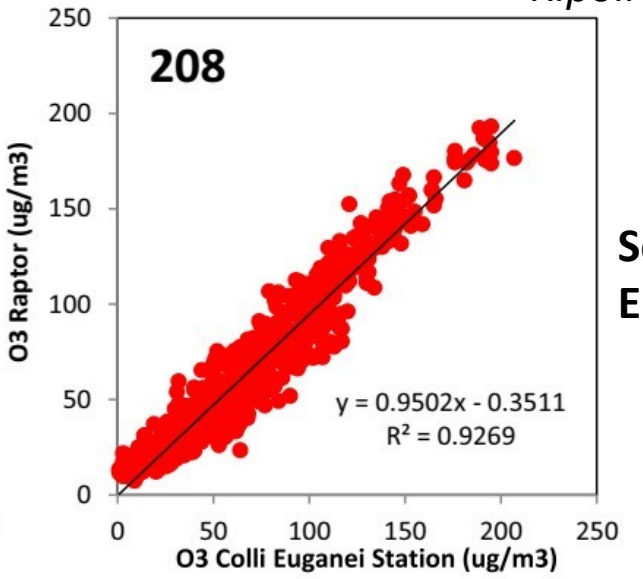


Results: limitations

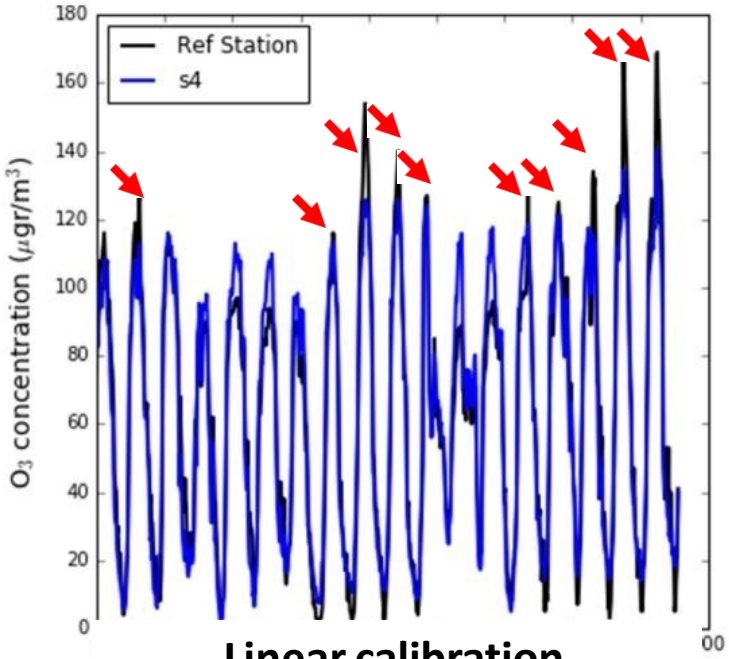
Ripoll et al., 2019

Sensor: Metal oxide

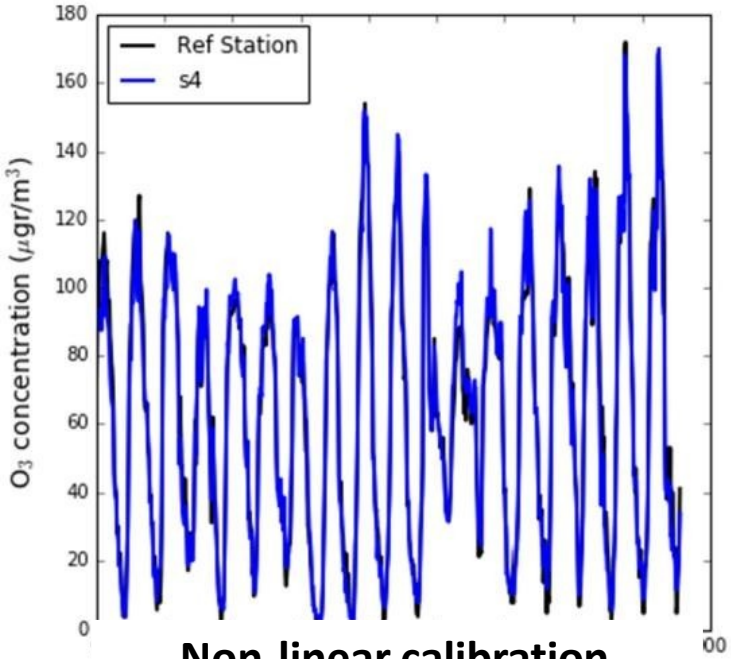




Sensor: Electrochemical

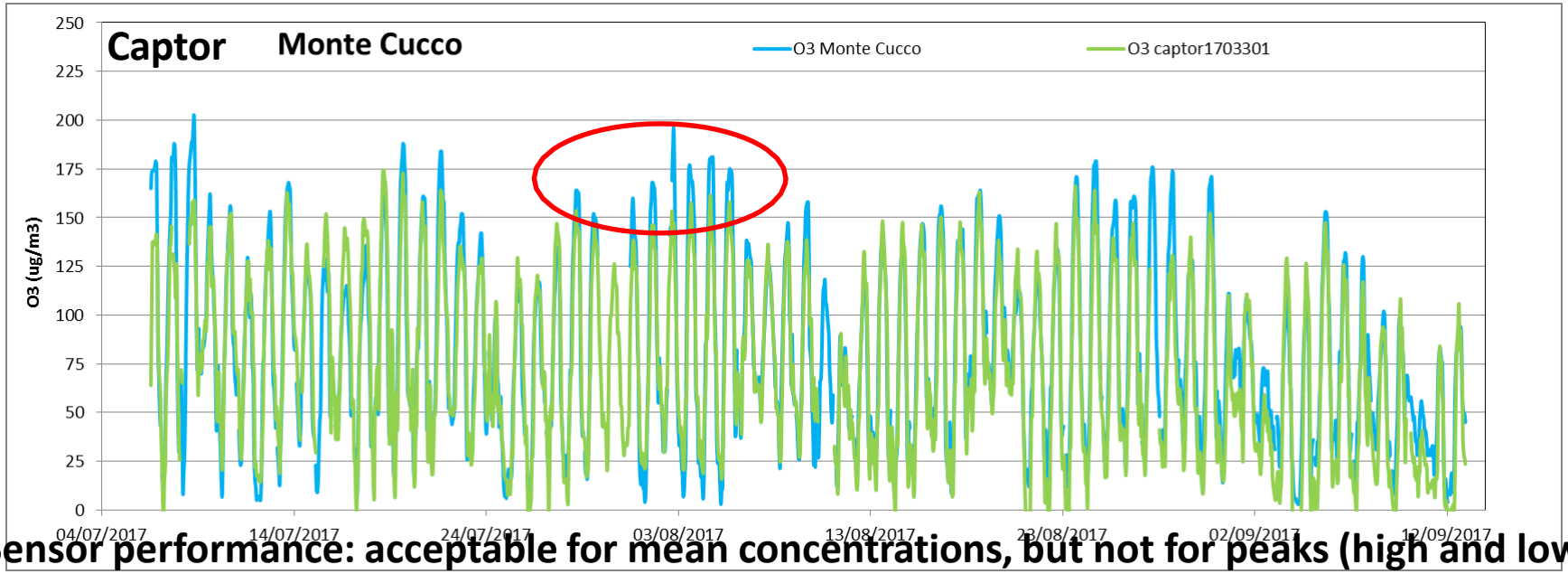


Linear calibration

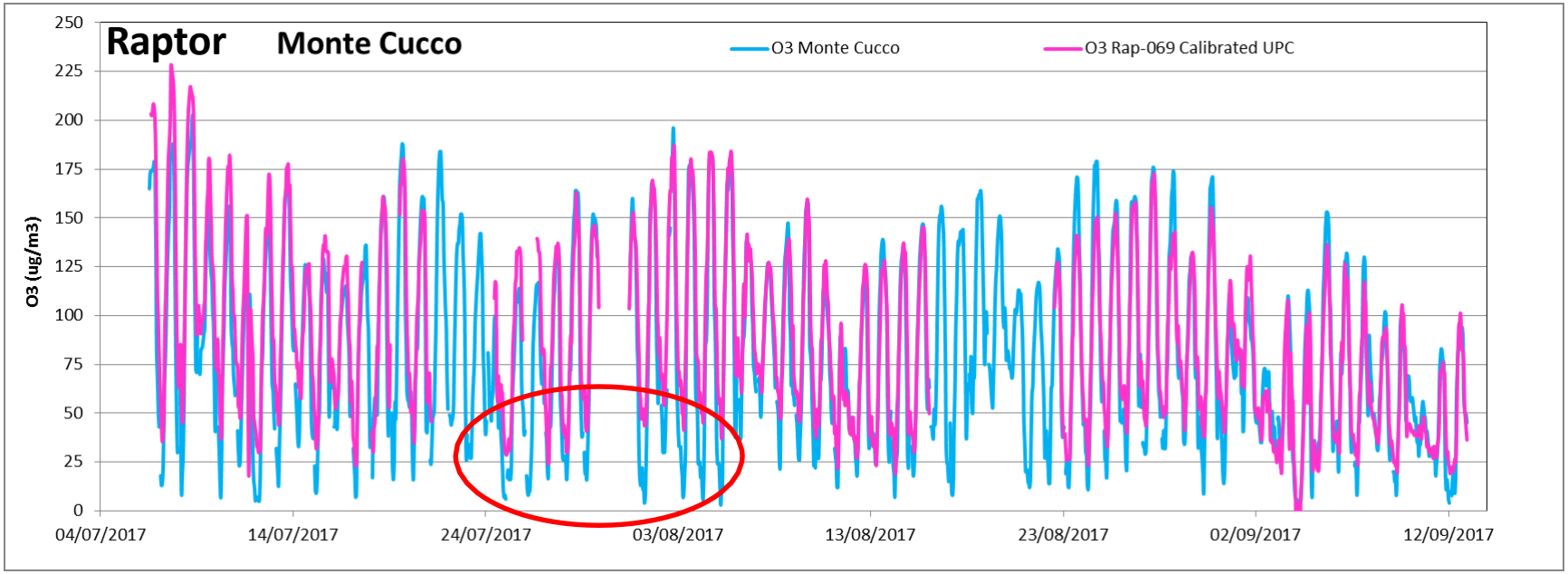


Non-linear calibration

Results: limitations



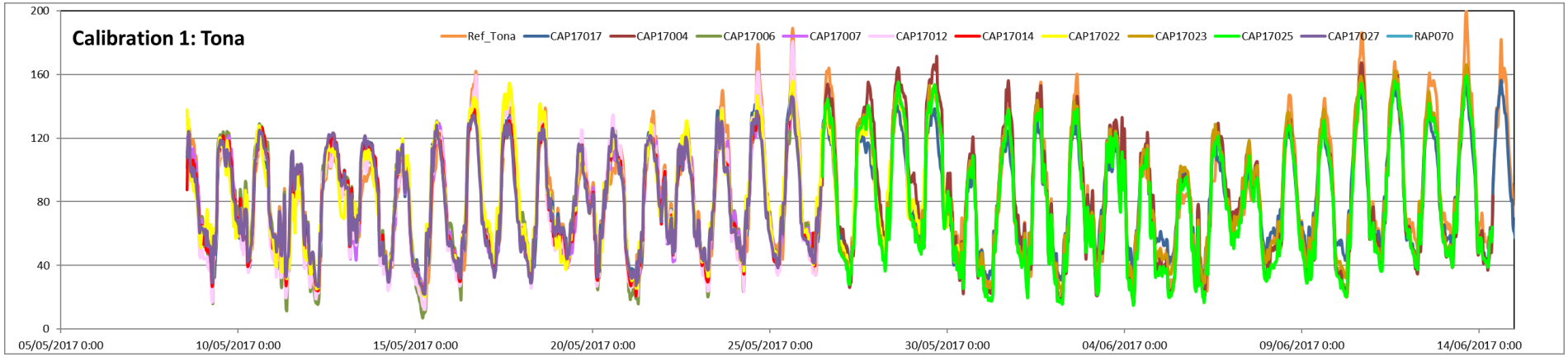
Sensor performance: acceptable for mean concentrations, but not for peaks (high and low)

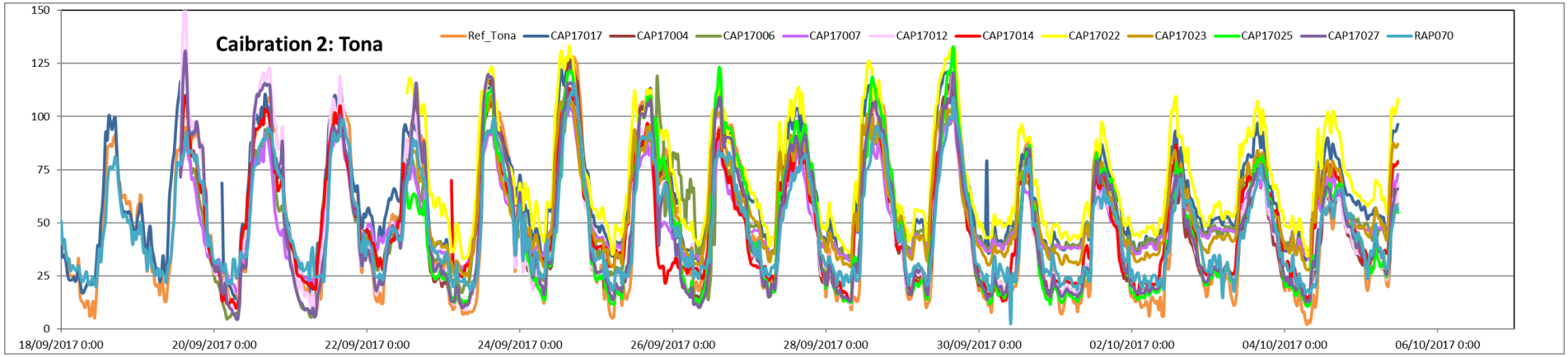


Results: limitations

UNIT-TO-UNIT VARIABILITY

10 Captor + 1 Raptor nodes co-located at a reference station (May-June)

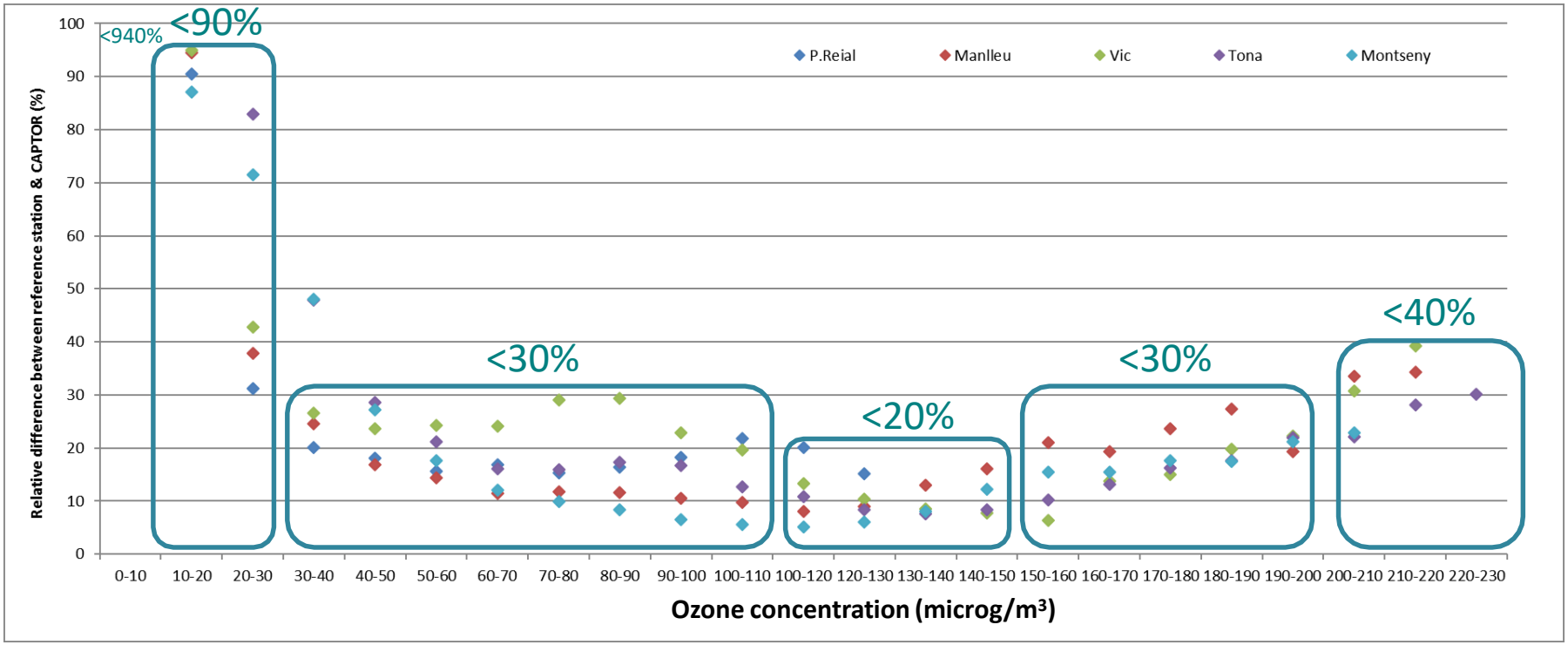




Intra-unit variability increased significantly during Calibration2 period (Sept-Oct)

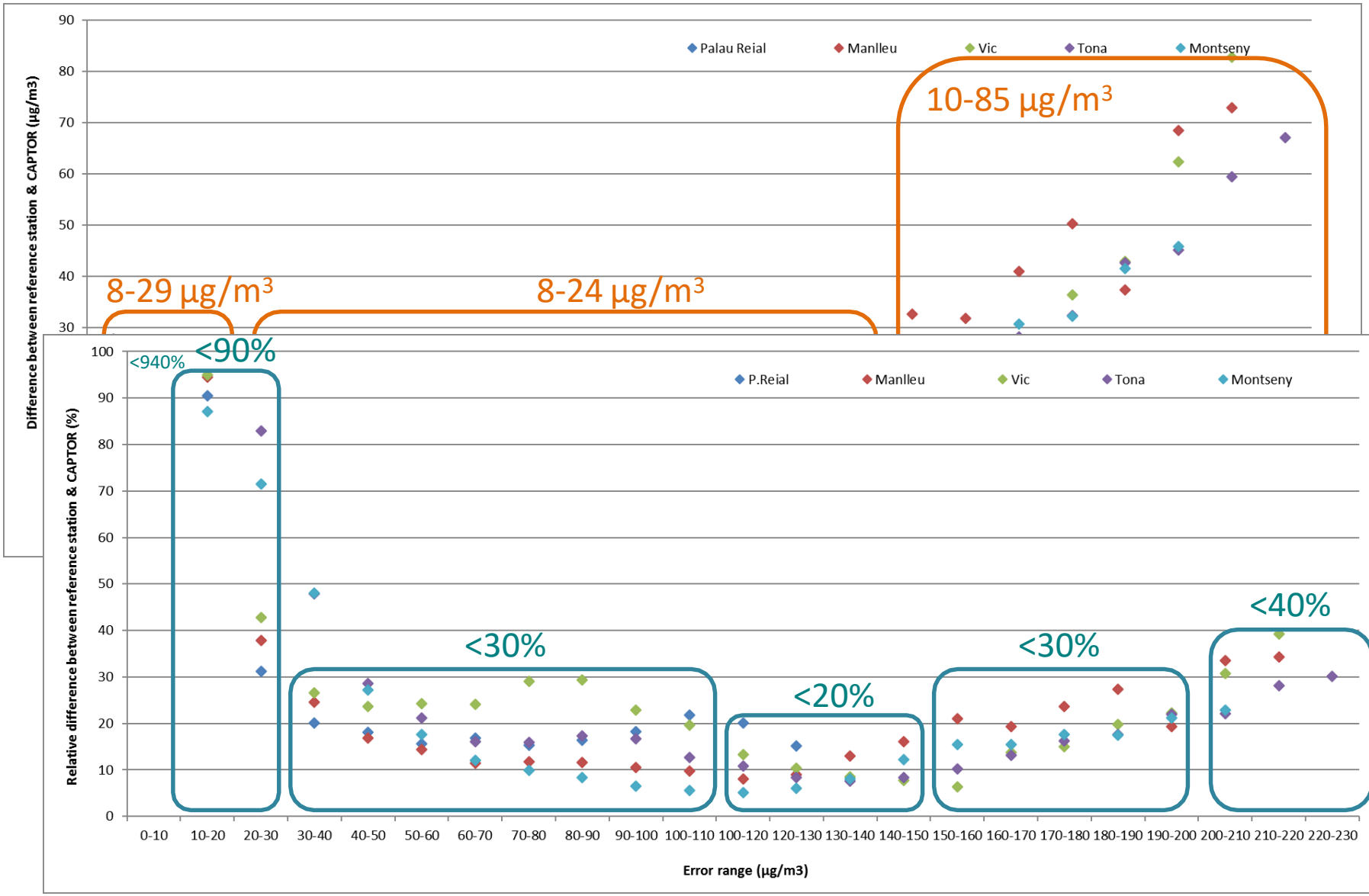
Cause: lower concentrations? Ageing?

QUANTIFICATION OF UNCERTAINTIES



Uncertainties

QUANTIFICATION OF UNCERTAINTIES



Conclusions

- Ozone pollution is an issue in Southern and Central Europe, mainly affecting rural areas
- High interannual and spatial variability
- CAPTOR: Sensors were deployed in a citizen science approach
- Ozone data obtained has good scientific quality for sensor research and for awareness raising
- Peak concentrations not recorded by sensors
- Uncertainties = 20-40%, depending on ozone concentration
- Sensor data are more conservative than reference stations – no social alarm created

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THANK YOU FOR YOUR ATTENTION!

COLLECTIVE AWARENESS PLATFORM
FOR TROPOSPHERIC OZONE POLLUTION

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